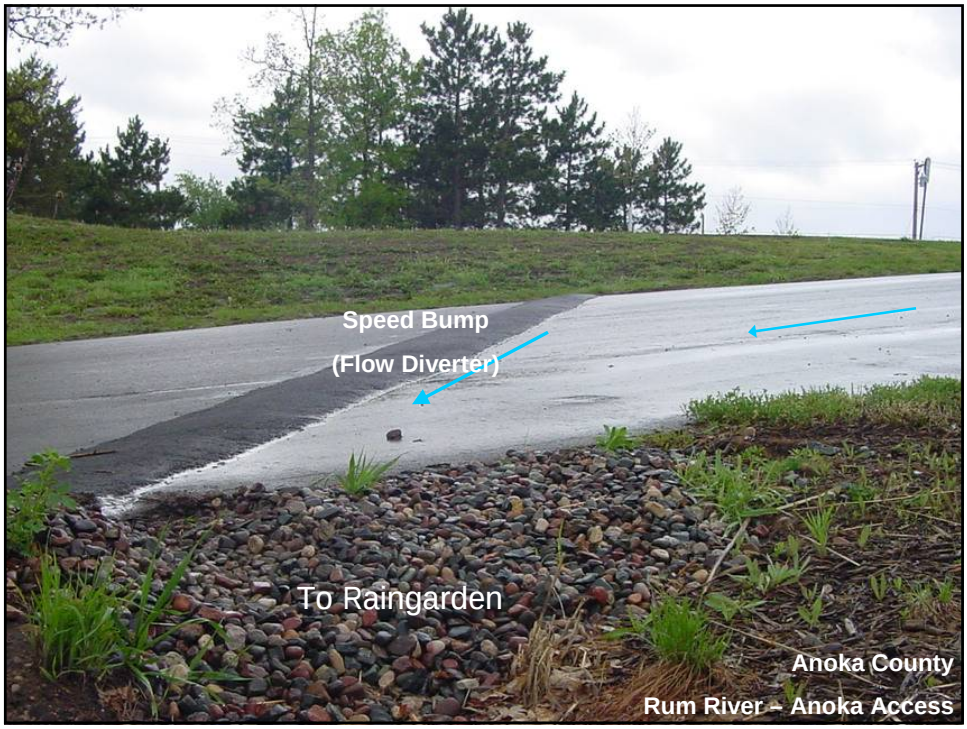

Bioretention For Infiltration
(1004)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

A bioretention device is an *infiltration device*[1] consisting of an excavated area that is back-filled with an engineered soil, covered with a mulch layer and planted with a diversity of woody and herbaceous vegetation. Storm water directed to the device percolates through the mulch and engineered soil, where it is treated by a variety of physical, chemical and biological processes before infiltrating into the *native soil*.

II. Purpose

A bioretention device may be applied individually or as part of a system of stormwater management practices to support one or more of the following purposes:

- Enhance storm water *infiltration*
- Reduce discharge of storm water pollutants to surface and ground waters
- Decrease runoff peak flow rates and volumes
- Preserve base flow in streams
- Reduce temperature impacts of storm water runoff

III. Conditions Where Practice Applies

IV. Federal, State and Local Laws

Users of this standard shall be aware of applicable federal, state and local laws, rules, regulations or permit requirements governing bioretention devices. This standard does not contain the text of federal, state or local laws.

V. Criteria

A. Site Criteria

1. A site selected for construction of a bioretention device shall be evaluated in accordance with the WDNR Conservation Practice Standard 1002, "Site Evaluation for Stormwater Infiltration" and shall meet the site requirements of that standard.

2. The following site criteria shall also be met:

   a. Private Onsite Wastewater Treatment System (POWTS) – The bioretention device shall be located a minimum of 50 feet from any POWTS and shall not be *hydraulically connected* to the POWTS dispersal cell or cause negative impacts such as cross contamination.

Site Evaluation for Stormwater Infiltration
(1002)

Wisconsin Department of Natural Resources
Conservation Practice Standards

I. Definition

This standard defines site evaluation procedures to:

1. Perform an initial screening of a *development site*[1] to determine its suitability for infiltration.
2. Evaluate each area within a development site that is selected for infiltration.
3. Prepare a site evaluation report.

II. Purpose

1. Establish methodologies to characterize the site and screen for exclusions and exemptions under Chapter NR 151 Wis. Adm. code.
2. Establish requirements for siting an *infiltration device* and the selection of design infiltration rates.
3. Define requirements for a site evaluation report that insures appropriate areas are selected for infiltration and an appropriate *design infiltration rate* is used.

III. Conditions where Practice Applies

This standard is intended for development sites being considered for stormwater infiltration devices. Additional site location requirements may be imposed by other stormwater infiltration device technical standards.

IV. Federal, State and Local Laws

Users of this standard shall be aware of applicable federal, state and local laws, rules, regulations or permit requirements governing infiltration devices. This standard does not contain the text of federal, state or local laws.

V. Criteria

The site evaluation consists of four steps for loc the optimal areas for infiltration, and properly s infiltration devices.

- Step A. Initial Screening.
- Step B. Field Verification of information c in Step A.
- Step C. Evaluation of Specific *Infiltration*
- Step D. Soil and Site Evaluation Reporting

The steps shall coincide, as much as possible, fi when the information is needed to determine th following: 1) the potential for infiltration on the 2) the optimal locations for infiltration devices, the design of the infiltration device(s). Steps A shall be completed as soon as possible in the sp process. See Consideration VI.M for an examp

Step A. Initial Screening

The initial screening identifies potential locatio infiltration devices. The purpose of the initial screening is to determine if installation is limite ss. NR 151.12(5)(c)5. or NR 151.12(5)(c)6., an determine where field work is needed for Step I Optimal locations for infiltration are verified in B.

Information collected in Step A will be used to the potential for multiple infiltration areas versu relying on a regional infiltration device. Smalle infiltration devices dispersed around a develop are usually more sustainable than a single *regio device* that is more likely to have maintenance groundwater mounding problems.

The initial screening shall determine the follow Note: Useful references for the existing resourc and information are listed in Considerations VI J.

1. Site topography and slopes greater than 20
2. Site soil infiltration capacity characteristics defined in NRCS County soil surveys.
3. *Soil parent material.*
4. Regional or local depth to groundwater and bedrock. Use seasonally *high groundwater* information where available.

Conservation Practice Standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your local WDNR office or the Standards Oversight Council office in Madison, WI at (608) 833-1633. WDNR, WI 02/04

[1] Words in the standard that are shown in italics are described in VIII. Definitions. The words are italicized the first time they are used in the text.

Bioretention For Infiltration
(1004)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

A bioretention device is an *infiltration device*[1] consisting of an excavated area that is back-filled with an engineered soil, covered with a mulch layer and planted with a diversity of woody and herbaceous vegetation. Storm water directed to the device percolates through the mulch and engineered soil, where it is treated by a variety of physical, chemical and biological processes before infiltrating into the *native soil*.

II. Purpose

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- Enhance storm water *infiltration*
- Reduce discharge of storm water pollutants to surface and ground waters
- Decrease runoff peak flow rates and volumes
- Preserve base flow in streams
- Reduce temperature impacts of storm water runoff

III. Conditions Where Practice Applies

Bioretention devices are suitable for small drainage areas where increased urban storm water pollutant loadings, thermal impacts, runoff volumes and peak flow discharges are a concern and the area is suitable for infiltration. Bioretention devices are best suited to providing on-site stormwater management opportunities adjacent to *source areas* such as landscaped areas, rooftops, parking lots and streets.

Bioretention devices are not suitable for controlling construction site erosion. These devices will not treat chlorides, and will be damaged by heavy loading of salt-based deicers.

IV. Federal, State and Local Laws

Users of this standard shall be aware of applicable federal, state and local laws, rules, regulations or permit requirements governing bioretention devices. This standard does not contain the text of federal, state or local laws.

V. Criteria

A. Site Criteria

1. A site selected for construction of a bioretention device shall be evaluated in accordance with the WDNR Conservation Practice Standard 1002, "Site Evaluation for Stormwater Infiltration" and shall meet the site requirements of that standard.
2. The following site criteria shall also be met:
   a. Private Onsite Wastewater Treatment System (POWTS) – The bioretention device shall be located a minimum of 50 feet from any POWTS and shall not be *hydraulically connected* to the POWTS dispersal cell or cause negative impacts such as cross contamination.
   b. Foundations – The bioretention device shall not be hydraulically connected to building or pavement foundations or cause negative impacts to structures.
   c. Slopes – Sloped areas immediately adjacent to the bioretention device shall be less than 20% but greater than 0.5% for pavement and greater than 1% for vegetated areas to ensure positive flow towards the device.
   d. Maximum Drainage Area – The area draining to the bioretention device shall not exceed 2 acres. The drainage area shall not contain significant sources of soil erosion.

Conservation Practice Standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your local WDNR office or the Standards Oversight Council office in Madison, WI at (608) 833-1633. Wisconsin DNR 07/06

[1] Words in the standard that are shown in italics are described in K. Definitions. The words are italicized the first time they are used in the text.

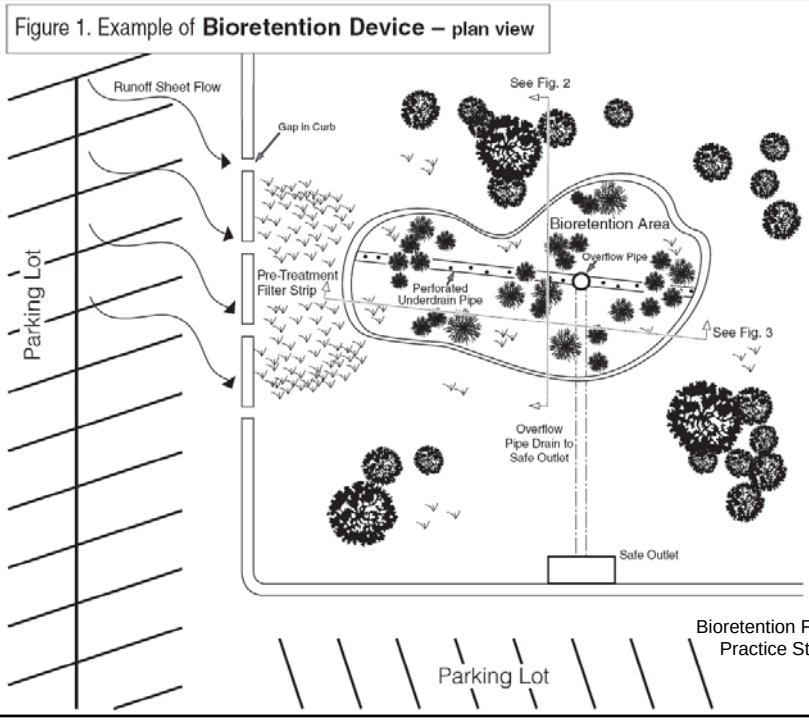
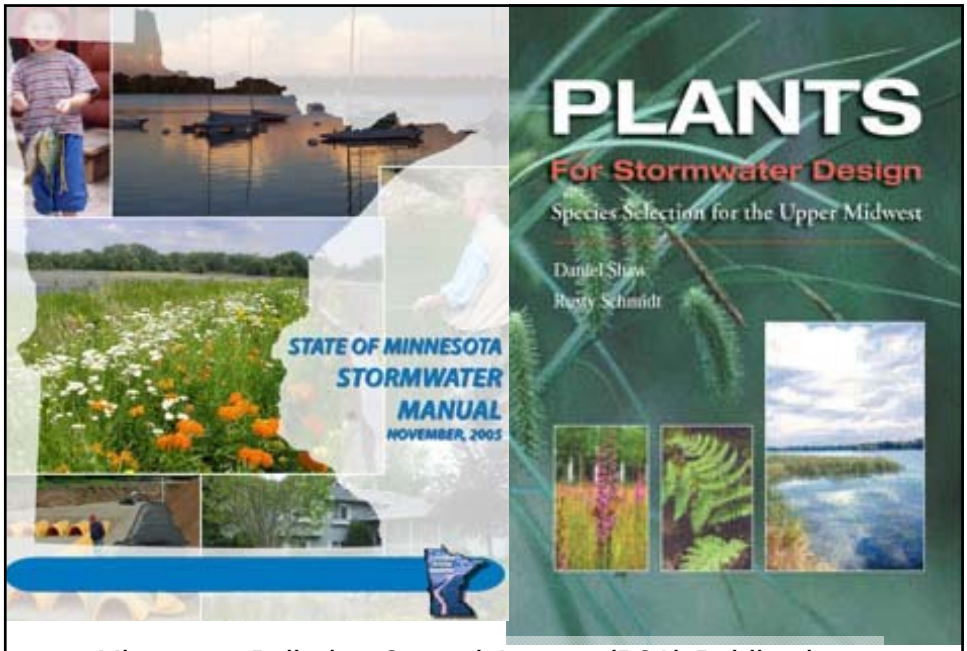


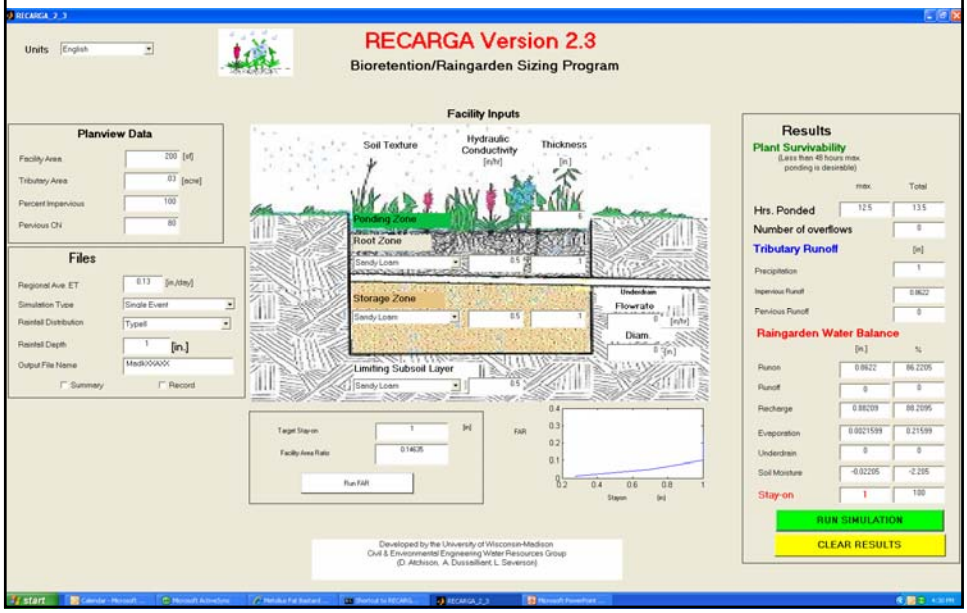
Figure 1. Example of **Bioretention Device** – plan view

WI DNR
Bioretention For Infiltration
Practice Standard 1004
Figure 1

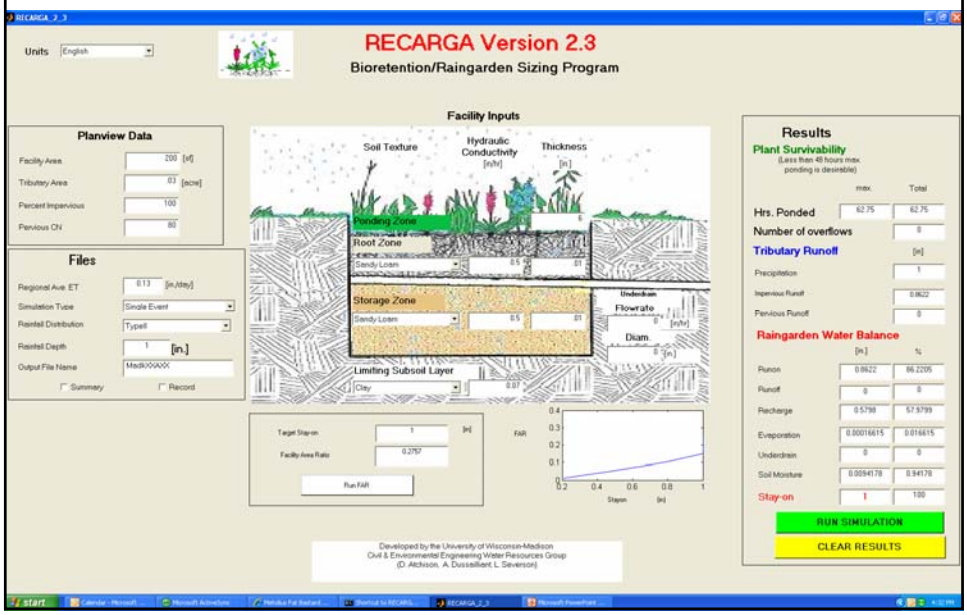


Minnesota Pollution Control Agency (PCA) Publications
www.pca.state.mn.us

Sandy Loam Sub-Soil: No Engineered Soils



Clay Sub-Soils: No Engineered Soils



"Commercial" Raingarden (Bioretention)
w/ Shrubs

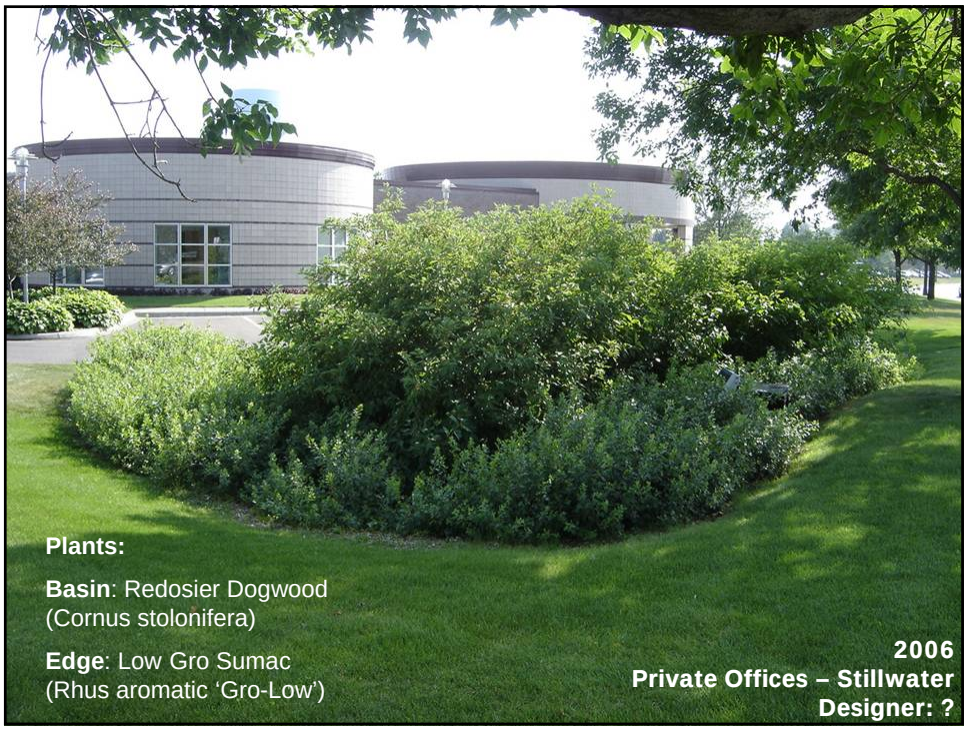
Private Offices – Stillwater
Designer: ?

"Commercial" Raingarden (Bioretention)

w/ Shrubs

What Cities Can Do: Require New Development to keep the first 1" of their stormwater On-Site

2001
Private Offices – Stillwater
Designer: ?



Plants:

Basin: Redosier Dogwood (Cornus stolonifera)

Edge: Low Gro Sumac (Rhus aromatic 'Gro-Low')

2006
Private Offices – Stillwater
Designer: ?


Existing Depression
Place riser on existing flush-mount drain
Mulch (smother existing weak lawn)
Plant
Lake Harriet Community School (Minnehaha Creek Watershed)

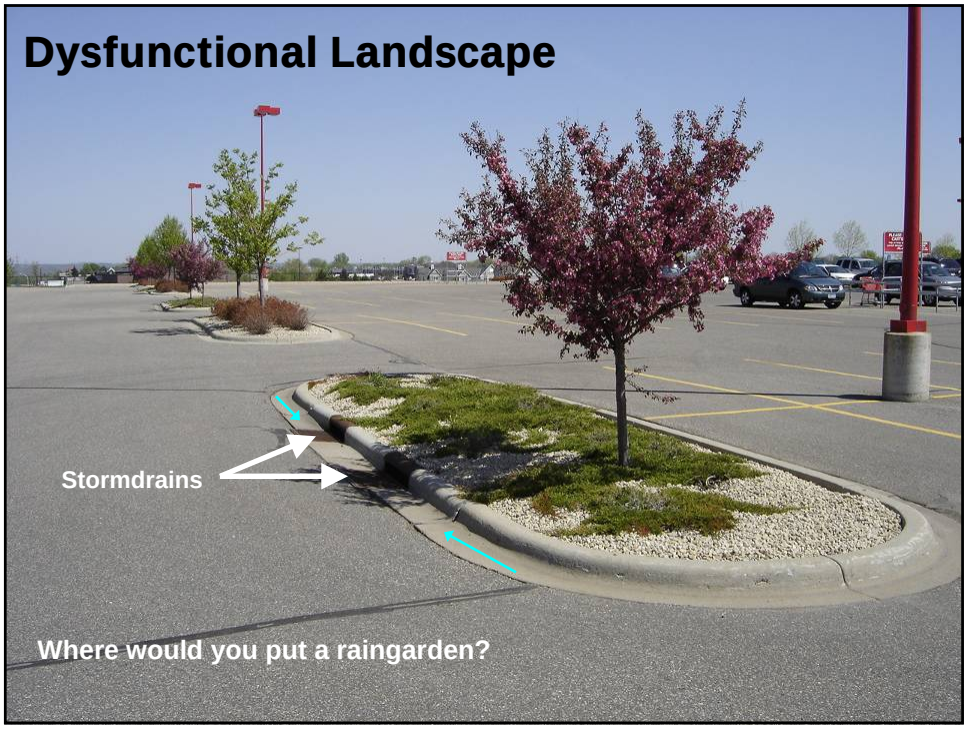

6" Riser / Adjustment Ring (provided by Mpls Public Works)
Lake Harriet Community School mulching/planting day


Lake Harriet Community School planting day (raingarden)


1 year later

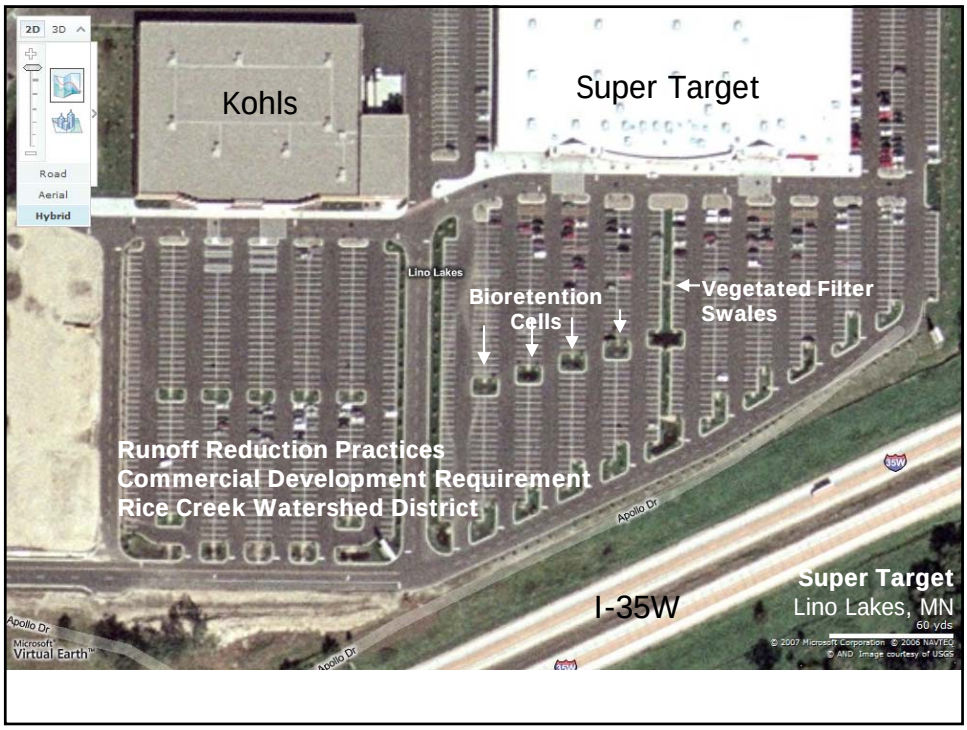

Swale
Pipe
Trench
Drain
State Fairgrounds – Eco Experience Building
Capitol Region Watershed District
Designed by:
Barr Engineering


City of Prior Lake
Public Works
Parking Lot Reconstruction Project at City Hall


Dysfunctional Landscape
Stormdrains
Where would you put a raingarden?


Multifunctional Landscape
Maryland


Commercial Development Requirement
Rice Creek Watershed District
Super Target
Lino Lakes, MN


Kohls
Super Target
Lino Lakes
Bioretention Cells
Vegetated Filter Swales
Runoff Reduction Practices
Commercial Development Requirement
Rice Creek Watershed District
Apollo Dr
I-35W
Super Target
Lino Lakes, MN
Road
Aerial
Hybrid
Microsoft Virtual Earth™


Conservation Area
Target is committed to preserving our natural habitat.
Help keep this protected area safe by not entering
without permission from the Target Store Manager.
We appreciate your cooperation.

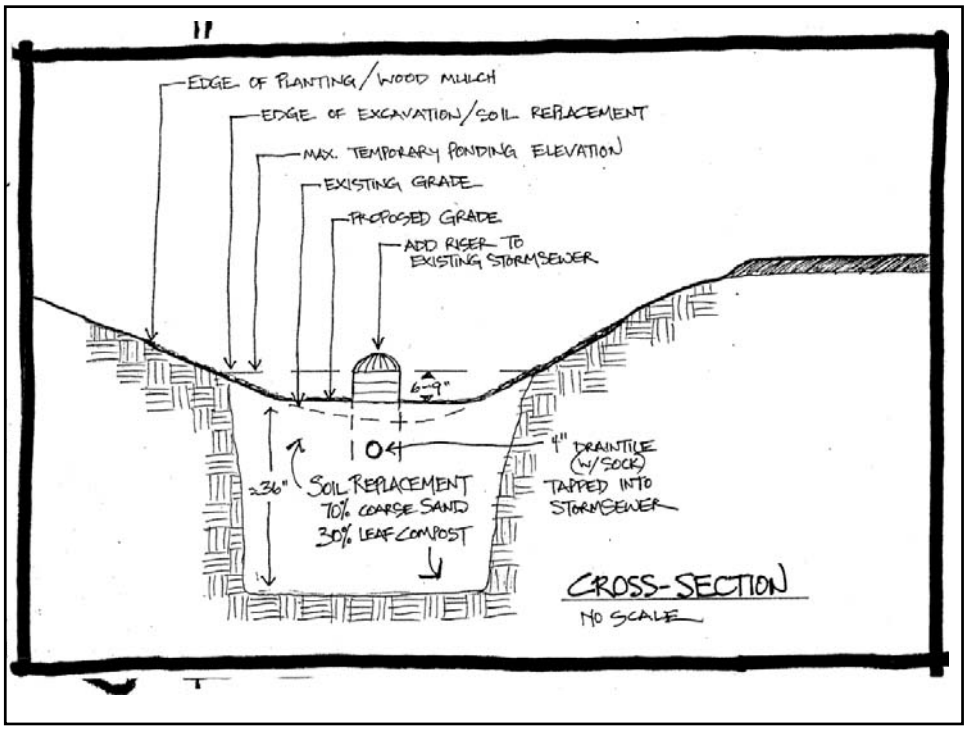

DNR Boat Launch
Eden Prairie, MN

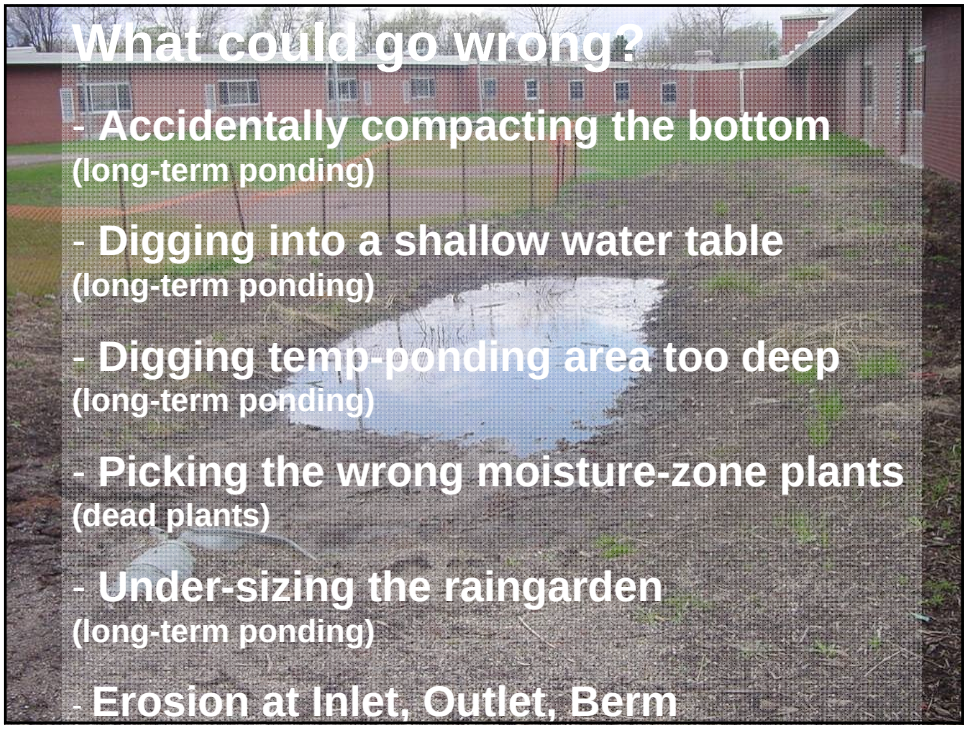

DNR Boat Launch
Eden Prairie, MN


Where would you put a raingarden?
Expo Elementary
St. Paul, MN

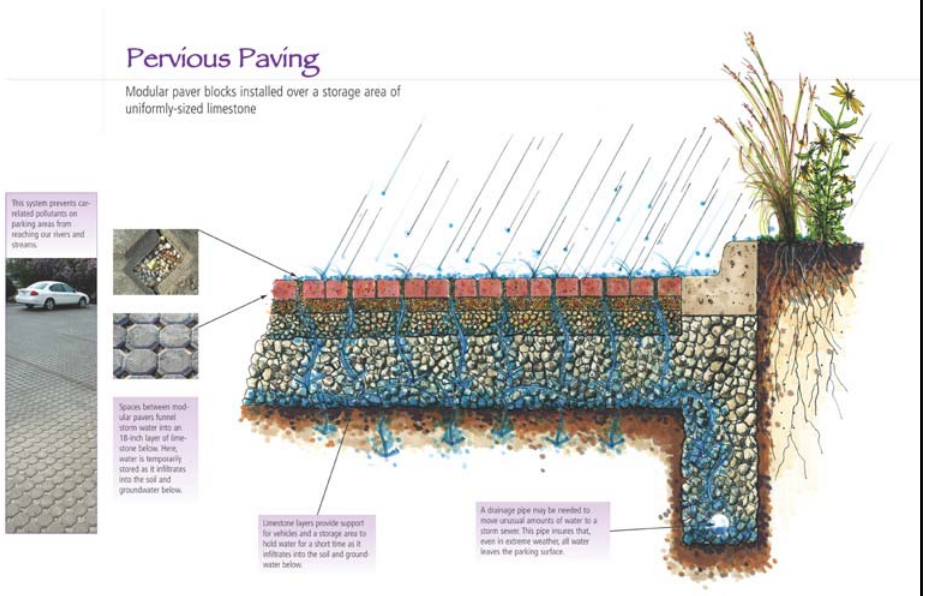

Pea-gravel
Sediment-capturing Inlet
(Easier cleanout)
Ended up using as 'gravel filter' instead – to also use as playground
Expo Elementary
St. Paul, MN


Soil
Replacement
Area


EDGE OF PLANTING/WOOD MULCH
EDGE OF EXCAVATION/SOIL REPLACEMENT
MAX. TEMPORARY PONDING ELEVATION
EXISTING GRADE
PROPOSED GRADE
ADD RISER TO EXISTING STORMSEWER
6-9"
10'
4" DRAINTILE (W/SOCK) TAPPED INTO STORMSEWER
≥36"
SOIL REPLACEMENT
70% COARSE SAND
30% LEAF COMPOST
CROSS-SECTION
NO SCALE

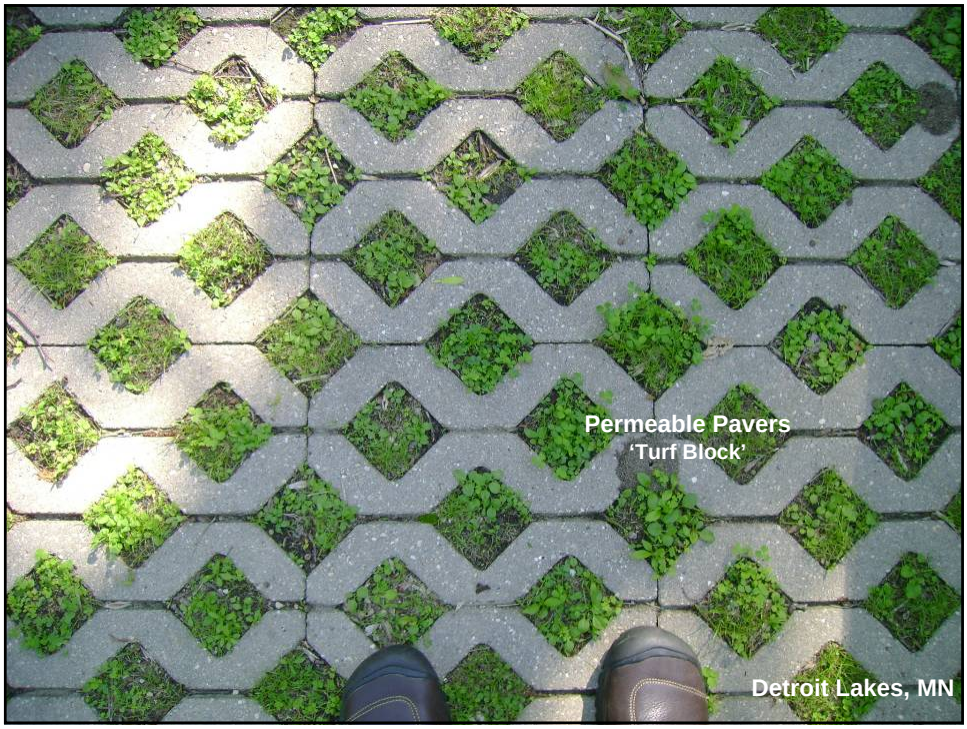


Worthington


Pervious Paving
Modular paver blocks installed over a storage area of uniformly-sized limestone
This system prevents car-related pollutants on parking areas from reaching our rivers and streams.
Spaces between modular pavers funnel storm water into an 18-inch layer of limestone below. Here, water is temporarily stored as it infiltrates into the soil and groundwater below.
Limestone layers provide support for vehicles and a storage area to hold water for a short time as it infiltrates into the soil and groundwater below.
A drainage pipe may be needed to move unusual amounts of water to a storm sewer. This pipe insures that, even in extreme weather, all water leaves the parking surface.

NRCS-Iowa


919-093
Permeable Pavers
'Turf Block'
Detroit Lakes, MN


Permeable Pavers
'Turf Block'
Detroit Lakes, MN


Permeable-joint Pavers
'Eco-Stone' (Borgert)

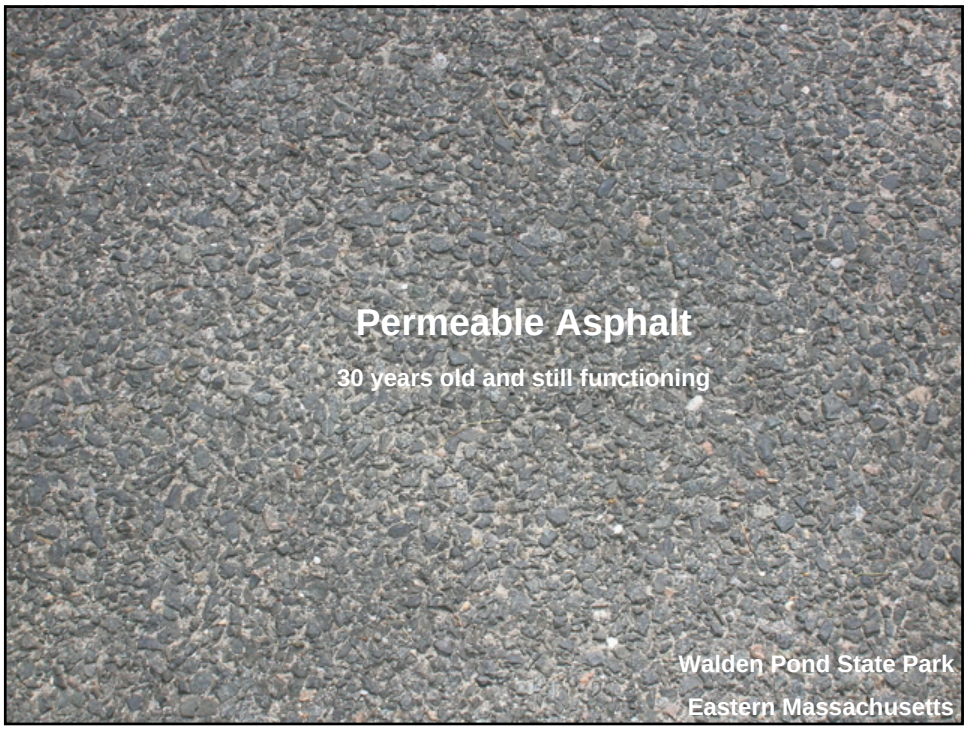

Permeable-joint Pavers
'Eco-Stone' (Borgert)
Dakota County


Permeable Pavers
'Eco-Stone'
U of M Landscape
Arboretum'


Permeable-joint Pavers
'Eco-Stone'
Schmeltz Volkswagen
Hwy 36 & White Bear Ave
Maplewood
Ramsey-Washington Metro Watershed District Project

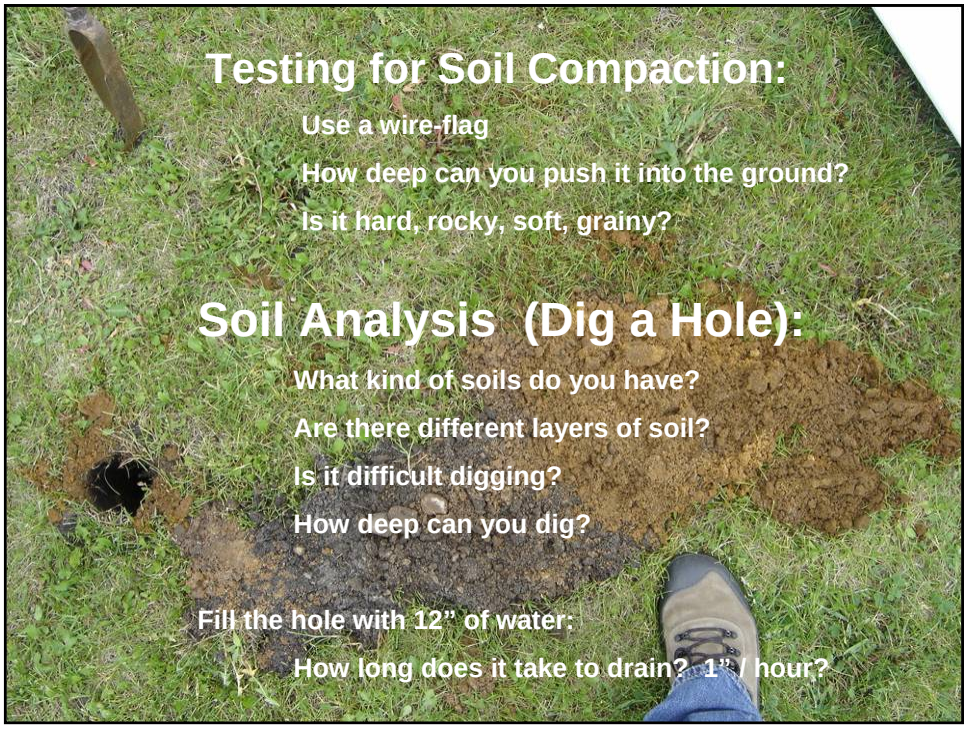

"Traditional" Asphalt
Permeable Asphalt

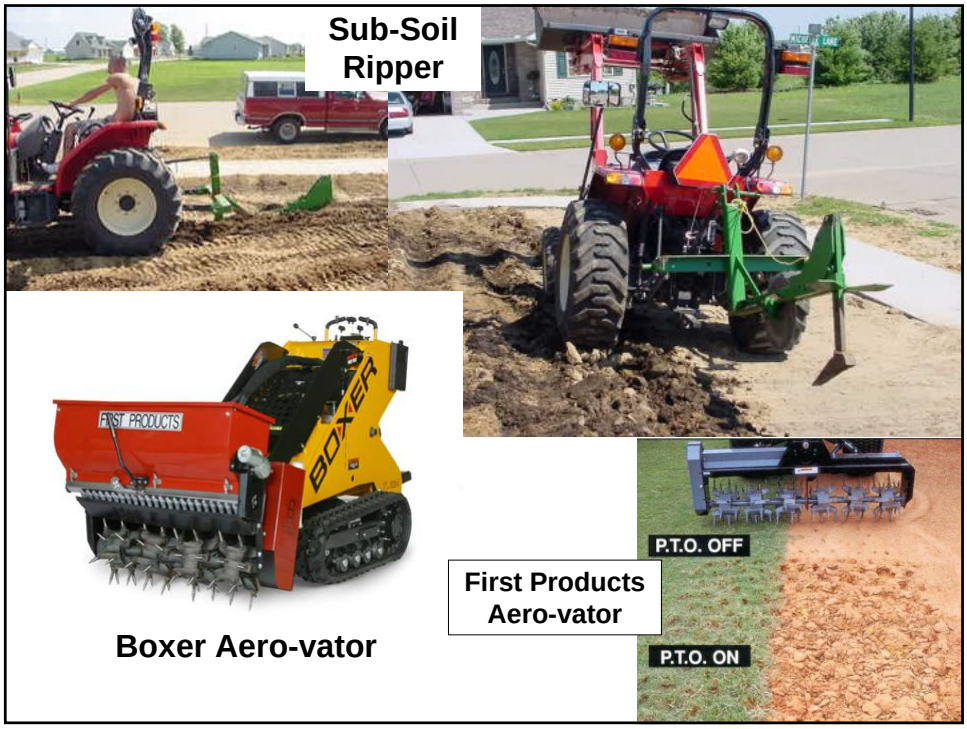

Green Roof
Permeable Asphalt
Ramsey-Wash. Metro W.D.
Little Canada, Mn


Permeable Asphalt
30 years old and still functioning
Walden Pond State Park
Eastern Massachusetts

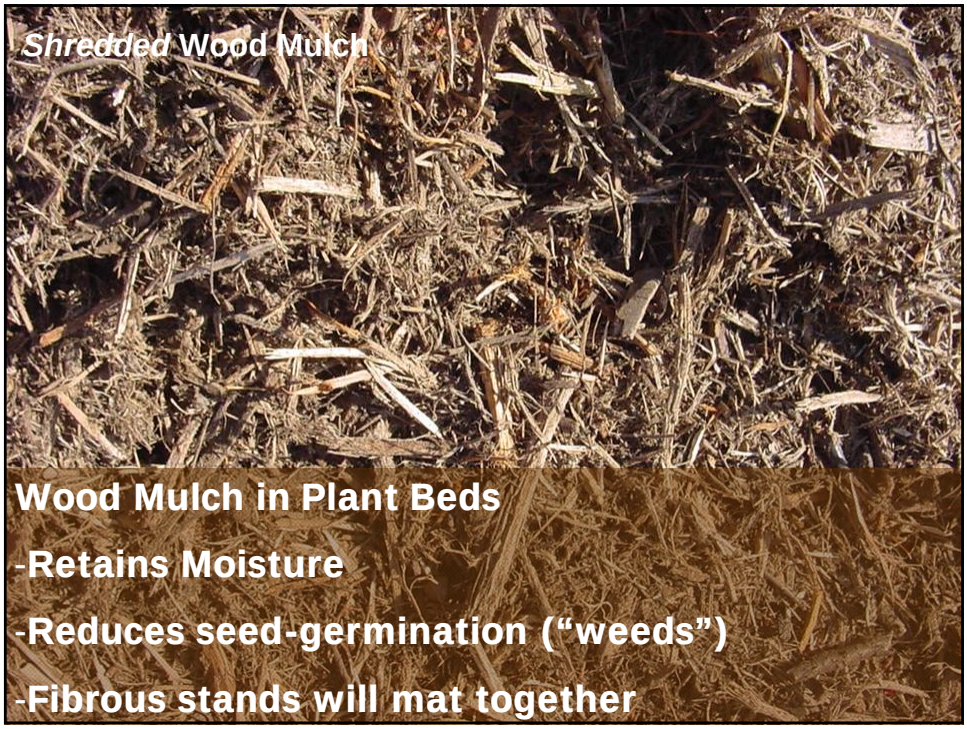
Water-Smart Landscaping

- Reduce Soil Compaction (aerate / add organic matter / mulching)
- 3” Mow Height (promotes deeper root growth, reduces moisture loss)
- Turf grass Selection (Drought-tolerant / deep-rooted selections)
- Smarter-Watering (low-volume drip-irrigation / targeted / rain-sensors, etc)
- Rainwater Harvesting
  - Rainbarrels / Cisterns & Pumps (to re-use rainwater)
- Low-Water-Use Landscapes
  - Selecting ‘Right Plant for the Right Place’
  - Utilize Deep-Rooted Plants
- Rainwater-Abosrbing Landscapes
  - Permeable Hardscapes (patios, driveways, etc.)
  - Strategically-placed tree, shrub and perennial planting areas
  - Vegetated-Filter Swales (when moving water)
  - Raingardens (to really soak it in)
- Soil-Stabilizing Landscapes
  - Slope Stabilization & Buffers (Lakes, Streams, Upland Slopes, etc.)


Testing for Soil Compaction:
Use a wire-flag
How deep can you push it into the ground?
Is it hard, rocky, soft, grainy?
Soil Analysis (Dig a Hole):
What kind of soils do you have?
Are there different layers of soil?
Is it difficult digging?
How deep can you dig?
Fill the hole with 12" of water:
How long does it take to drain? 1" / hour?


Sub-Soil Ripper
FIRST PRODUCTS
BOXER
Boxer Aero-vator
First Products Aero-vator
P.T.O. OFF
P.T.O. ON


Source: City of Plymouth
Cost: Free
Other Sources:
Recycling Centers
Landscape Nurseries
Leaf Compost (well-aged)
(Re-introducing Organic Matter)


Shredded Wood Mulch
Wood Mulch in Plant Beds
-Retains Moisture
-Reduces seed-germination ("weeds")
-Fibrous stands will mat together


Wood –*Chip* Mulch
Chips Can Float


What could you do with this?


Mulch & Plant Slopes